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STATE-OF-THE-ENVIRONMENT REPORTS

Hazardous environmental events

Report of the Executive Director

The Governing Council in its decision 11/1, section II, requested the Executive Director to include a description and analysis of any exceptional major environmental events in his annual state-of-the-environment reports. The Executive Director has consequently reported to the Governing Council on such issues. The present report describes the major hazardous environmental events that occurred from January 1989 to January 1991.

Suggested action by the Governing Council

The Governing Council may wish to:

1. Take note of the report of the Executive Director on hazardous environmental events;

2. Request the Executive Director to bring to the attention of all Governments the events described in this report;

3. Further request the Executive Director to keep under review the different environmental events and to report to the Governing Council at its seventeenth session in 1993 on any major events that may occur.

ALASKA OIL SPILL

1. On March 24, 1989, the supertanker "Exxon Valdez" ran aground on Bligh Reef, Prince William Sound (Alaska), spilling over 38 million litres of crude oil into this highly environmentally sensitive area. (1)

2. The "Exxon Valdez" is a single skin tanker, roughly 300 metres long, 50 metres wide and 27 metres deep. Its deadweight is 213,755 tons and at the time of the grounding it was loaded with some 200 million litres of crude oil from Prudhoe Bay (Alaska North Slope) that had been pumped to the Alyeska marine terminal in Valdez through the trans-Alaska pipeline. (1)

3. Prince William Sound is one of the largest tidal estuarine systems on the North American continent and much of its area was largely pristine until the "Exxon Valdez" incident. It is an area of great natural beauty, and its relative accessibility makes it a favourite location for local recreation. Its rich natural resources form the basis for major commercial fisheries for pink and chum salmon and Pacific herring, as well as smaller fisheries for other species of fish and crustacea. It is also home to seals, sea otters and several species of whale. (1)

4. The location of Prince William Sound in the sub-Arctic region adversely affects the natural ability of the environment to regenerate itself. Low temperatures mean that oil is physically and biologically degraded at slower rates than in temperate zones. In addition, the physical features of the shoreline and its remoteness are added difficulties for clean-up operations. (1)

5. Together, the above-mentioned circumstances led to the worst oil spill in the history of the United States of America (1), and maybe in the world in terms of ecological damage, although globally the accident ranks only tenth in terms of the amount of oil spilled. (2)

6. The response to the spill was directed towards two goals: to prevent additional oil leaking from the damaged vessel, and to protect environmentally sensitive areas. The first goal was satisfactorily achieved through the transfer of the remaining oil to the "Exxon Baton Rouge", "Exxon San Francisco" and "Exxon Baytown" without any significant additional spills. (1) However, the protection of sensitive areas at an early stage was hindered by several factors.

7. Although the contingency plan prepared by the Alyeska terminal covers scenarios including the spill of about 31 million litres of oil, the equipment located at the terminal was not sufficient to cope with a spill of such magnitude. The response barge had been stripped of equipment, the quantity and size of containment boom was insufficient and there was a shortage of personnel. (1) In addition, during the first 24 hours few skimmers were working in the area, and those that were working did not have the possibility of transferring recovered oil to a receiving barge. (1)

8. As days passed following the accident, more and more personnel and equipment were transported to the area. On April 1, over one hundred vessels were operating in the area, 800 Exxon personnel, and over one hundred federal personnel. On April 13 these numbers had increased up to 250 vessels, almost 2,000 Exxon personnel and 500 federal personnel. As of April 10, Exxon had flown in over 1,700 tons of equipment. (1) When beach clean-up operations reached their maximum extent, more than 10,000 individuals were involved in the operations. (3)

9. The clean-up methods used to remove oil from the water surface comprised application of chemical dispersants, on-site burning and mechanical recovery. (1) The use of dispersants was not very successful due to the adverse weather conditions. During the first two days, the water was too calm to facilitate the proper mixing of the oil and the dispersant. Later, gale-force winds moved the oil to areas where the use of dispersants was not recommended. (1)

10. Burning was not widely used. In fact, only one test burning was performed with controversial results due to reports of eye and throat irritation from residents in the vicinity of the test site. (1) Nevertheless, from a technical point of view the controlled burning was quite a success, with an estimated

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efficiency of more than 98 per cent in removing from the water the 55,000-110,000 litres of oil burnt. (4)

11. Mechanical recovery was the preferred method because it removes oil without possible environmental effects. However, the distances involved brought considerable delays and difficulties in the transport and operation of skimmers and sorbent booms. The total amount of oil recovered from the sea was less than 3 million litres.

12. About 1,400 kilometres of shoreline within Prince William Sound were affected by the spill. The methods employed to clean-up this shoreline have been: high- and low-pressure water spraying, sorbent booms, manual removal and, at a later stage, enhancing of natural biodegradation processes. (1, 3)

13. The first three of the clean-up techniques mentioned-above are widely known, but the enhancing of biodegradation processes had never before been undertaken on such a scale. A co-operative agreement between the United States Environmental Protection Agency's Office of Research and Development and Exxon was the basis for launching a study to test the performance of bioremediation in treating contaminated beaches in Prince William Sound: the Alaskan Oil Spill Bioremediation Project. The core idea was to enhance the activity of micro-organisms that degrade oil, by making available to them the nutrients necessary for their growth (namely, nitrogen and phosphorous), which do not occur in the appropriate quantities in an oil-rich environment, by means of on-site application of fertilizers. (3) The results of the tests were highly promising in terms of effectiveness and lack of adverse environmental impacts, although more research is still necessary. (3)

14. The effects of the oil spill on the Prince William Sound ecosystem can be considered as twofold: an immediate impact, and a long-term impact. The immediate impact on some groups is as follows:

(a) The oil slick can adversely affect plankton, through either suffocation or toxic effects. As plankton includes floating eggs and larvae, long-term populations of fish, molluscs and crustacea, as well as algae may also be affected; (1, 3)

(b) Oil present in the surface or in the water column can find its way into the insulating fur coat of sea otters, leading to loss of buoyancy and hypothermia, or into the feathers of marine birds, disabling them. It may also be ingested, with toxic effects. (1, 3, 5) Tens of thousands of marine birds and almost one thousand sea otters have been reported dead, but the actual toll could be much higher; (6)

(c) Intertidal animals, such as barnacles and mussels, have little or no mobility. Oil in intertidal areas can therefore cause severe mortality among these animals; (1)

(d) Through the trophic chain or through their gills, fish can absorb chemicals that may have toxic effects and also impair swimming ability, making them vulnerable to predators; (5)

(e) Terrestrial animals, such as river otters, mink, bald eagles and deer, can also suffer an indirect impact by scavenging oil carcasses or browsing on oiled kelp. (1) In the summer following the accident, bald eagle productivity was 16 eaglets for every 100 nests in the oiled area, compared with 49 eaglets for every 100 nests in a non-affected area. (6)

15. Long-term impacts are still being evaluated, but they may arise primarily from habitat and food chain disruption, as well as the decreased survivability and reproduction rates of animals exposed to the oil. These effects, while perhaps not immediately fatal to a given individual, have a direct bearing on the survival of the species as a whole and consequently on the ecosystem of which it is a member. (1, 3) Another factor can contribute to the long-lasting effect of the spill: the oil present in low-energy areas (areas exposed to low to moderate wave energy and/or tidal currents) may remain present for years with only slow chemical and biological processes to degrade it, serving as a reservoir for a chronic input of oil into subtidal sediments, where it may affect benthic organisms over the long term. (1) In this respect, the efforts under the Alaskan Oil Spill Bioremediation Project may be of great importance, given the possibility of using this technique to ameliorate surface and subsurface oil biodegradation. (3)

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